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This is a comprehensive survey of factors involved in providing for the health needs of populations living in arctic and subarctic areas of the world. As one might expect from the author, this material is presented on the basis of an ecologic analysis which makes it possible to deal with biological, social, economic, political, and cultural factors as they relate to physical and mental health.

FACTORS TO BE CONSIDERED IN DELINEATING "ARCTIC" AND "ANTARCTIC" IN TERMS OF HEALTH PROBLEMS AND SERVICES

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ONLY SEVEN countries stretch their territories beyond the Arctic Circle (Canada, Denmark, Finland, Norway, Sweden, the United States, and the USSR). In five of them (Canada, Finland, Norway, Sweden, and the USSR) the northern part is directly connected by land with the rest of the national territory. In one case (Alaska) another country is squeezed in between, and in another (Greenland, Denmark) an ocean lies between the "mother country" and its arctic province. Also, the island of Iceland may be counted, although its territory only touches the Arctic Circle in the north.

Quantitatively dominating the picture are the vast, strongly underpopulated northern areas of the USSR, the United States, and Canada. Official census figures for 1956 give the total population of Siberia as 18.4 million, representing an increase of 3.3 million since 1939, the bulk of this in the eastern part.*

Alaska's population is less than a quarter of a million, of which 18,000 are Eskimos, 16,000 Indians, and 6,000 Aleuts.† The northwestern territories of

* According to H. W. Ahlmann.

† U. S. Department of Health, Education, and Welfare.

Canada have a mere 23,000 people (1962) comprising approximately 8,500 Eskimos, 5,000 Indians, and 9,500 whites.

Greenland's population is (1959) close to 32,000, of whom more than 29,000 are native Greenlanders (born in Greenland, mostly a mixture of Eskimos and whites), the rest Europeans.

As far as the two Scandinavian countries (Sweden and Norway) and Finland are concerned, the "arctic" and "subarctic" population includes (1957-1958) approximately 1.5 million with about half a million in each country.* Out of these, a mere 33,000 are Lapps, the rest Scandinavians or Finns.

The population of Iceland is (1962) 180,000.

Generally speaking, the density of population decreases with the latitude. An exception is found in Norway where most of the population in the north lives along the northern coastline. The tempering influence of the Gulf Stream creates extraordinarily mild climatic conditions up to the very northern tip of western Europe, Nordkapp in Norway, beyond 71° N.L.

None of the three large countries mentioned (Canada, the United States, and the USSR) has so far suffered under population pressure. Nevertheless, one may rather safely predict a very considerable increase in the population of the northern parts of these countries. This results partly from the more rapid growth of the resident populations of these areas, due to reduced infant mortality and other causes of death, combined with continued high birth rates. More, however, it will probably result from the rapid stepping up of the exploitation in the near future of some of the rich national resources of these areas (coal, metals, precious stones, oil, timber, cheap animal protein). Also, the meteorological and other scientific and strategic interests in these areas have grown by leaps and bounds. According to the figures of Ahlmann, the program for the industrialization of Siberia calls for half a million new settlers per year.

As far as Greenland, the Scandinavian countries, and Finland are concerned, an increase in population in these areas in the near future is also visualized, although not of great magnitude and due mainly to industrialization.

In the Antarctic where there is no indigenous population, the transient population groups living there for meteorological, other scientific, as well as military purposes, constitute only a few thousand.

Even with a rather liberal interpretation of the terms "arctic" and "subarctic" the total population of these areas is therefore negligible compared to the teeming millions of the tropical and subtropical areas of the globe. On the other hand, the countries bordering on the north have been advanced countries also in the sense that they have been able to establish extensive social and health services for their peoples. For generations, therefore, these countries with larger or smaller populations living under arctic conditions have been faced with the special disease and health problems in such areas and have been able to find solutions tempered by their general national approach to health and social services. The rich future of the northern areas which is now predicted also includes new settlements in more or less virgin areas. Therefore, if planning and execution are properly handled, it might be possible to learn from the experience of others and perhaps avoid some of the mistakes made elsewhere when health and social serv-

* To reach this figure, the three northernmost provinces of Norway (Nordland, Troms, and Finnmark) have been included as well as the two northernmost in Sweden (Norrbotten and Västerbotten) and in Finland (Uleåborg and Lapland).

ices have had to be established for new groups of populations.

Delineation of Areas

Due mainly to prevailing ocean currents, the climate and, as a consequence, the botanical and zoological boundaries do not correspond to latitudes. This is particularly obvious in the North. Just to mention one example—in Canada the treeless zone stretches approximately 1,000 kilometers south of the Arctic Circle (to approximately 59° N.L.), while in Norway dense evergreen forests (mostly pine) may be found nearly 400 kilometers north of the Arctic Circle (to 70° N.L.).*

No generally accepted system for delineation of areas termed "arctic" or "subarctic" exists. The terms used for convenience differ with the purpose—climatic, botanical, zoological, economic, political, and the like.

More and more commonly accepted is the practical distinction based on the dominant climatic factors—and therefore on flora and fauna—in:

1. Polar Regions—A world mainly of frozen water (ice and snow) and rocks, devoid of most vegetation, and with rather scanty animal life on land (or ice).
2. Tundra—Characterized by the frozen subsoil (permafrost), scanty vegetation of mosses, lichen, brush, somewhat richer fauna, and seasonal abundance in insects.
3. Taiga—The coniferous forest areas, botanically and zoologically richer and gradually shading into more fertile agricultural areas.

If one also accepts taiga as part of the subarctic areas, one is brought rather far south in some countries, unless one introduces the qualification that the evergreen coniferous forest should be more or less the only form for vegetation, meaning that farming would be excluded. However, if one counts the cold-resistant varieties of potatoes, the quickly ripening varieties of wheat and other cereals, a great number of vegetables, and others, one will find that in certain northern areas the hectic summer offers unexpected possibilities for agriculture.†

In the northern part of the world where large land masses stretch continuously beyond the taiga into the tundra, even into the polar zone, this has reflected itself not only in flora and fauna but also in human life. Men of different ethnographic types have settled and have established their very old cultures and ways of life, separated not only by insurmountable distances but also by languages and customs. A rather varied picture has gradually developed. Southwards, the contact with and increasing influence from other parts of the country have been of fundamental importance. These "southerners" have been representing technically more advanced populations. The technically underdeveloped people of the North, in other words, have been and still are separated from the masses of the underdeveloped areas in the tropical and subtropical zones and have lacked the strengthening feeling of being numerous.

The underdeveloped peoples of the North are therefore in some respects different from those in more densely populated areas, and in some cases the number representing special ethnographic groups has been so small that even the danger of extinction has been imminent.

Quite different is the situation in the Antarctic. There, no taiga area exists; there is no tundra to speak of and no indigenous population (perhaps one might make an exception for the south-

* The "Northernmost Forest in the World," a small cluster of trees, is found at the city of Hammerfest, approximately 470 kilometers north of the Arctic Circle.

† Halfway between 68° and 69° N.L., I have personally observed sweet peas grow as much as 10-12 cm per day (meaning per 24 hours). During the continuous day in the midnight-sun area, the plant does not rest at "night."

ern tip of South America). Flora and fauna are correspondingly meager, including insects and parasites.

In the Antarctic, in other words, one finds practically only polar conditions, partly of a harsher nature than in the northern polar zone. The problems of the Antarctic from the health viewpoint, although important, represent only a special section of the problems in the North and even here tempered by the fact that no indigenous or bordering population exists accustomed to conditions close to the polar region.

As far as present knowledge goes, no specific arctic or antarctic disease or group of diseases seem to exist in the sense that they are only found in these areas. On the other hand, the host-agent relationship will necessarily here, as elsewhere, be conditioned by the special milieu factors dominating in the area under discussion. Also, the relative importance of the various groups of human diseases will differ from other parts of the world.

Taking into consideration the situation in which we find ourselves, faced with the rapidly progressing habitation of the northern areas, it does not seem realistic to be too strict in the delineation of the areas under discussion.

In spite of the great variations, it is possible to describe a combination of conditions also relevant to health problems and services which more or less characterize these areas as compared to others, namely: (a) low temperature; (b) snow covered ground and/or frozen soil for long periods of the year; (c) prolonged periods of darkness and of sunlight giving altogether a low average of sun radiation; (d) special features of fauna and flora, including scanty or lacking possibilities for agriculture; (e) low density of population; and (f) specific and sometimes great difficulties of communication and transportation.

What then are the main factors to be taken into consideration when trying to delineate the health problems and health services in these areas?

Physiological Adaptation

Is a more or less fundamental physiological adaptation necessary for human beings living in arctic and antarctic areas, especially because of the exposure for prolonged periods to low temperatures? To people who have never experienced cold climate, as we know, the prospect of low temperature holds something threatening and, in a mysterious way, life endangering. Available evidence seems to have considerably clarified the situation, and the question put here may perhaps now generally be answered in the negative.

Man going North carries with him his microclimate, and indigenous people living even under primitive conditions have demonstrated great ability to protect themselves effectively against excessive cold. The slight lowering of the critical temperature of man, the variation in basal metabolic rates, in blood pressure, blood composition, and so forth, are in themselves most interesting but perhaps do not deserve to be termed fundamental physiological adaptations.

More interesting and useful details will be gathered no doubt in the future concerning the adaptation of the human body (and mind) to the special conditions in the far North and South, but it seems justified already to conclude that there is no fundamental difference from adaptation to other environmental circumstances. It is as "normal" to live in arctic and subarctic areas as in other parts of the world, although conditions in such areas may not in all respects offer optimal environment for man. One might even say that it is more difficult for man to adapt to the climate of the tropics than to the polar climate. If the surrounding air temperature is close to or even above normal body temperature, the human body has difficulty in

getting rid of the surplus heat created by muscular activity. In a tropical climate, therefore, there is a climatic limitation to the amount of physical work which can be performed by man while this is not the case in a cold climate.

Physical Environment Created by the Cold

The low temperature, snow and ice, and frozen subsoil during the whole or part of the year, accentuated often by strong winds, create a number of engineering problems related to health conditions—housing, heating, storing, and the like. These conditions present especially challenging problems to the sanitary engineer—the provision of safe water, disposal of human waste, refuse, or sewage.

Solutions developed elsewhere cannot slavishly be applied here. It is not only that water sources, the possibilities of their contamination, and problems of piping water differ from conditions elsewhere, but the terrain is flat and the absorbtive capacity of the soil for sewage is often strongly reduced. Also, biological processes normally so useful in the elimination of sewage and refuse are more or less inhibited.

A considerable amount of experience has, however, been gained over the years in regard to methods for neutralizing the complicating effects of the climate and, although costly, it is now technically possible to establish safeguards against these environmental threats to the health of man.

Nutrition

Nutritional problems have played a relatively dominant role in the literature on health problems related to arctic and subarctic areas. This is to be expected. Arctic explorers had to plan and to undertake their hazardous trips into the ice-desert at a time when scientific insight in matters of human nutrition were still unsatisfactory and tragedies therefore common. Some have been preoccupied with the extreme fat and protein consumption of the Eskimo, others with the supposedly increased caloric requirements in a cold climate, others again with the supposedly increased requirements for certain vitamins.

At present the air seems to be clearing as well in this field. Although the last word has not been said, there seems to be more or less general consensus on the following points.

It is highly questionable whether the low temperature in itself asks for higher caloric intake. Of course, physical exercise, especially during the summer season, the inhibiting effects on free movement of heavy clothing, and so forth, have to be taken into consideration.

No convincing evidence has been forthcoming to prove that there exists a specific need for fat, for protein, or for carbohydrates.

Also, there is no final evidence to demonstrate needs for an extraordinarily high intake of vitamin C, thiamine, or other vitamins.

This does not, of course, mean that special nutritional problems do not exist in these areas. In the polar and tundra regions, there is lack of fuel for heating and cooking—with certain unhealthy food habits as a result—practically complete lack of locally grown cereals, vegetables, and fruits (with the exception of expensive hot-house production). In the taiga areas, there is, of course, plenty of fuel (wood), but the number of agricultural products is strictly limited.

While the aboriginal groups have adapted themselves admirably to the available meager food resources, the question of adequate food for people coming from technically advanced coun-

tries is first and foremost a question of cost, transportation, storage and, not to be forgotten, preparation. Boredom with too well-known dishes easily enters the picture, especially during the long and dreary winter season. Also, especially during the long winter period, there is a definite danger of overfeeding among station personnel.

Closer study of the nutritional habits of indigenous populations in the North has contributed much to remove some previous misunderstandings and misinterpretations. This more "normalized" view of the nutritional needs of man living in a cold climate should not come as a surprise. The climate in which man lives is not the outer meteorological climate but primarily the "inner" climate, that is, the temperature between the clothing and the skin. The only exposed areas of the skin are the face and, to a certain extent, the hands. Since these are the "thermometers" of the human body, they will, especially in a person not accustomed to cold air, give a very strong reaction, thereby misleading the individual.

From the viewpoint of health, the nutritional problems do not offer theoretical difficulties for nonindigenous groups spending relatively short periods in the cold area. Indigenous populations, on the other hand, often get into trouble when their original food habits are changed by the contact with newcomers.

Ecology

Some of the most interesting factors to be taken into consideration from the health viewpoint are found in the special selection of pathogenic agents found in these areas and the sometimes unfamiliar relationships between host, vector, and pathogen created by the specific environmental conditions. Considerable light has been shed also in this field in the last few decades, but there is still much to learn. Although the corresponding problems of tropical and subtropical areas are manifold and complicated, the ecological problems, especially of the Arctic, are formidable.

Generally, the situation may be characterized as follows: Insects play a much less important role as vectors of disease in the arctic and subarctic climate than in tropical areas. The nuisance value of insects on the other hand is sometimes very high, although limited to the warmer season. Animals (mammals, birds, and fish) play a relatively greater role as conveyors of disease. There is reason to believe that certain pathogenic microorganisms may survive longer in a cold climate than in a warmer one. On the other hand, their proliferation may be inhibited. As far as parasitic diseases are concerned, their transfer from the animal or other host to man during the warm season is, in most cases, a condition for the survival of the pathogen.

The nosological picture is therefore definitely different from that found in other parts of the world, colored by the close relations of man to the animal world (hunting, fishing, close contact with dogs).

Prominent among these animal-borne infestations and infections are helminthiasis and certain other parasitic diseases (Diphyllobothrium, trichinosis, Echinococcus, pinworm, brucellosis, tularemia, rabies, ornithosis, and leptospirosis). Other communicable diseases commonly found in these areas include tuberculosis, venereal disease, and intestinal and respiratory infections.

There are not yet sufficient data available to demonstrate which of these diseases may be limited to specific areas and which are more widespread.

The physical and psychological burdens seasonally placed upon man by the insect plague, especially in the tundra and taiga areas, should be underlined (mosquitoes, biting flies, and midges).

No one who has once encountered, for example, the incredibly thick and extensive clouds of mosquitoes will ever forget the experience. A not inconsiderable number of individuals are so susceptible to this form of nuisance that presence outdoors is made unbearable. It worsens the effect that this happens during the warm and sunlight season where outdoor activities are possible, productive, and sometimes very pleasant.

The potential danger of existing insects acting as vectors of disease cannot be excluded, neither can the importation of new varieties of insects.

Other problems may be created by migrating birds, bringing with them pathogenic agents from warmer climates.

In 1962 the World Health Organization arranged a conference on biological control in relation to medical entomology. Before embarking upon biological methods for combating nuisances of this type, exact basic ecological research is desirable. If not, one may jump from the ashes into the fire.

Sunlight

The environmental factor which shows the highest degree of regularity is, of course, the shifting light—long, dark winters; short, bright summers. North (or south) of the polar circle longer periods completely without sun are followed by correspondingly long periods where the sun is continually above the horizon 24 hours a day. The influence of these conditions on animal and insect life and on flora in these areas is, of course, more than striking. A person living in one and the same place during a whole year and experiencing both the sunny and the dark period may sometimes wonder whether he is in one and the same world.

Many indigenous peoples of the North lead a nomadic life, following, with animals, the lead of the seasons, while others are stationary.

Some biological effects of the sunlight are well known—dependency upon ultraviolet radiation for the synthesis of vitamin D in the skin. Until this was learned and methods for substitutional therapy found, rickets dominated in many northern areas, including those of northwestern Europe. It seems that production of vitamin D in the skin of man is closely related to the establishment of erythema by ultraviolet radiation. Since one of the conditions for production of erythema is that the sun reaches a certain height above the horizon (30° N.L.?), even the long continuous periods of sun in the very far northern and southern areas may not be able to release this biologically important reaction.

On the other hand, the dry, clean polar air represents a minimum of atmospheric absorption of the ultraviolet radiation which is also strengthened by reflection from snow, ice, and water.

That craniotabes and rachitis are not eradicated even in the rich and technically advanced countries with above average health services in the North is demonstrated, inter alia, by Haraldson in his Kiruna survey (1951-1952). Among 507 children, he found 128 with obvious softening of occipitalia on one or both sides and concluded that subclinical and manifest rachitis was still prevalent in this region at the time. He estimates that during five months of the year the sunlight is not strong enough to have any antirachitic effect. (Kiruna is a little south of 68° N.L.)

As far as the long continuous winter night is concerned, the inexperienced traveler will be pleasantly surprised to find that it is not really dark. Stars, moon, snow, ice and northern lights are always mentioned as contributing to this. More important, of course, is the fact that the sun is never very far below the horizon as it is never very high

above. The dark period, therefore, is not a real night, but represents a prolonged period of twilight. It is, therefore, also easy to demonstrate that the ultraviolet radiation starts before sunrise and ends only after sunset. In far northern and far southern areas, these periods are prolonged.*

As far as the relationship between health generally and sunlight is concerned, there is little concrete evidence to demonstrate the necessity or beneficial effects of sunlight. As a consequence, little emphasis is put upon the specific light conditions as a health factor in polar regions. Future research may demonstrate whether this somewhat negligent attitude is justified. Based upon general biological reasoning, it seems most improbable that the beneficial effects of sunlight should be limited to what is known until now. One may in this connection refer, for example, to the fundamental influence of sunlight upon life functions of certain animals,† or to the persistence with which human begins living in areas with limited amounts of sunlight gather year after year at places where they can "bask in the sun" (beaches and mountains), even at great economic sacrifice.

The "Dilution of Life"

The vast sparsely populated areas of the North and South where man lives individually or in small groups far apart offer most formidable obstacles to the establishment of adequate health services. It has often rightly been stated that the problems met with are not real health problems but problems of logistics, but for families and individuals living in these areas such terminological distinctions are of little help and the problems are certainly very real. This holds true for preventive medicine and even more for curative and rehabilitative services. As far as convalescents, the weak, the aged, and others not in their full strength are concerned, very great problems arise. These are not areas for "minus-variants."

Mainly, the difficulties arise from the fact that present-day health service units, in the preventive as well as in the curative and other fields, must have a certain size and complexity to be able to include the necessary amount of differentiation in knowledge, experience, and methodology. The population in the areas under discussion, however, very seldom or never constitute population centers big enough to justify the establishment of a fully specialized unit. Countries with hundreds of years of experience in this field, especially in the north of Europe, have solved their problems rather satisfactorily by a combination of:

1. Well-planned preventive services.
2. "All-purpose," front-line medical personnel.
3. Simple local medical institutions for first aid and diagnostic purposes.
4. Effective means of transportation.
5. Special arrangements for covering the cost of health services.

It has been proved beyond doubt that, at least as applied in areas with a relatively high educational level of the population and a well-developed sense and tradition of local responsibility, most satisfactory results can be produced. Since health services under such conditions are costly and since the population of these areas is generally of less

* The author got very satisfactory colors on photographs on ordinary daylight Kodachrome taken midway between 70° N.L. and 71° N.L. during the "winternight" in February.

† Willow ptarmigan, for example, exposed to moderate and even small amounts of light develop different phases of spring plumage and summer plumage during the winter months (November to February), thus indicating that light and not temperature is the main controlling factor both for the reproductive cyclus and the development of spring and summer plumages in these species (Høst).

economic power than the rest of the population of the same country, the cost of adequate services in such regions cannot be carried by the individual and the family directly and in proportion to their needs for such services. A "conditio sine qua non" for a good result is therefore either the establishment of some form of nationalized health services or other forms of prepaid health service programs based on an equalization of cost on larger groups of the population.

It is essential that the cost of transportation of medical personnel and of patients, pregnant women, and the like, should be included in the benefits* and that no pecuniary, professional, or other motivation be established to prevent the local representatives of the health services from transferring the patient or other health problem to a more central, and therefore bigger, unit if necessary or desirable. Also, it is essential that a system be established whereby the local health personnel may call upon a more highly specialized person to visit them when they run across a local health problem beyond their competence and which cannot be "exported" to more centrally located units. Experience shows that the existence and availability of adequate health services and transportation in case of emergencies play a dominant role in the feeling of security in isolated groups of population in these areas, especially those not accustomed to this form of life.

But the "dilution of life" in these areas has, of course, much wider implication in the field of health. Man is to a very high extent a "reflex machine." When stimulation is lacking, the response-activity is also lacking, and where activity is lacking, development stops. Inactivity to most people means stagnation. Only very few individuals have in themselves imagination and original resources strong enough to meet situations where isolation from stimuli is the dominant feature. The question of stimuli is, however, a relative one. Where the city dweller from the South may sense nothing but frozen vastness and grey-white desolation, the Lapp or Eskimo is continuously filling his eyes, ears, and other sense organs with impressions both of importance and of esthetic value. Mental health conditions in very advanced, sophisticated countries, with a tremendous variety of stimuli, and where even the choice between pleasurable ways of spending leisure time may present a problem, certainly do not prove that mental health is proportionate to the number of stimuli.

* In Norway, with approximately one-third of its territory and one-eighth of its population north of the Arctic Circle, one single visit by the local doctor to his patient may, for transportation only, cost as much as a round trip railroad ticket, Oslo-Rome-Oslo.

Human and Sociological Factors

None of the above-mentioned factors involved in delineating health problems and health services in arctic and antarctic regions can, however, be advantageously discussed in the abstract, per se. We are speaking of health problems of man and health services for human beings, and therefore the factors mentioned above and others can be discussed concretely only in relation to the types of population with which one has to deal in these parts of the globe. With a certain amount of simplification, one may distinguish four different types of such populations:

1. Stable (permanent, "normal") populations, parts of relatively homogeneous populations of a country whose territory extends continuously into arctic regions and where the northern part of the country has for hundreds of years been regarded as an integral part of the country as a whole and even as an important part. Typical exam-

ples are Norway, Sweden, and Finland; to a lesser degree, the USSR. In recent years, Canada finds itself in this category.

To understand the position in these countries, it is necessary to be reminded that the over-all health service structure, including personnel, institutions, legislative, financial, and administrative settings, can only be understood as a part of the social and administrative structure of the country concerned. The main principles which govern national life in general, and especially in politics, economy, and other forms of interhuman relationships, will necessarily reflect themselves in the type of health service.

Health problems and health services in the type of population described above are normally regarded as parts of the health problems of the country as a whole. The part of population living in the northern areas claims, in principle, health conditions and services identical, or at least qualitatively equal, with those of other parts of their own country. The "welfare state" idea in the northwest and the "people's democracies" political system in the northeast both stimulate such an approach. Politically speaking, it is impossible for any group or party to promulgate the idea that health conditions in the North should not be on the same level as the southern part of the country.

Since, obviously, geographic, climatic, and other conditions of these areas create special problems of the well-known types (great distances, scattered population, restricted agricultural production, and the like), the ordinary, normal, and accepted system of health services will therefore need supplementation and special support in various ways (guaranteed high income for medical personnel, security for promotion to more southern areas, special arrangements for housing, means of transportation, and so forth) which are not easily compatible with the general principle of equality.

In my opinion, it is fair to say that some of the countries mentioned have been rather successful in applying their general health service system, with slight modifications, in such areas. It should be borne in mind that in these cases one deals mainly with populations accustomed for many generations to living under the local conditions and also having a relatively large degree of local government and responsibility. Partial resettlement is now taking place in some of these areas with public economic support, owing mainly to the change in equipment and methods for fishing (motorization, larger boats), forestry, and the like.

2. New settlers from more southern parts of the country, especially for industrial purposes, forestry, and other economic activity, create new health problems in these areas inhabited for hundreds of years. These are due to a lesser degree to the industry itself (pollution of water supplies and air, occupational disease), and more to the creation of densely populated spots, as well as to the fact that the newcomers are not accustomed to the living conditions and generally bring with them habits of nutrition, housing, leisure, and other ways of life which they know from their more "civilized" place of origin further south. It is their natural tendency to ask for at least similar conveniences and services as those which they left behind in the field of health, education, transportation, cultural activities, and sports and athletics. This tends in the countries of the type mentioned to underline further the trend toward equalization and to stimulate rapid development. Most of these new "frontier" groups represent young populations.

3. Quite different is the outlook, the

claims, and needs of the stable, indigenous populations of such areas, ethnographically different from the rest of the population in the same country and originally with only sporadic contact with them. As examples may be mentioned Lapps, Indians, Eskimos, Aleuts, and northern Siberian tribes. These groups have for centuries, perhaps for thousands of years, been living their own life characterized by a remarkable degree of adaptation to the specific conditions of their place or places of life. They were in principle self-sufficient, based on what nature offered. They have until recently had no possibility of knowing what today's health services may offer in the way of protection of life and health. Generally speaking, they offered, as far as health conditions are concerned, a picture not unlike that of technically underdeveloped countries elsewhere—high birth rate, high infant mortality, and high mortality in younger age groups; as a consequence, low average length of life. Food and other life habits are often unhealthy and sanitary environmental conditions unsatisfactory. During the last 50 to 100 years and with increasing intensity, two trends are obvious: (a) Increased contact with "intruders" from the South and intensified exploitation of some of the riches of the country. During this period, especially in the opening phase, missionaries have played an important role in many parts. (b) Changing of life patterns of such isolated groups as a result of this contact and also as a result of the change in methods of productivity.

The early period of this "mixing together" of the indigenous populations with the predominant inhabitants of the country concerned was often characterized by rather brutal exploitation of the riches of the northern area without much regard or respect for the aborigines. Gradually a reaction toward such attitudes developed and now, in most such places, attempts are being made to "normalize" conditions also as far as environmental hygiene and health services generally are concerned. However, the planning of this "normalization" often suffers from underestimation of the difficulties arising when life habits are being altered. Food may serve as a typical example. Since these local inhabitants are mainly poor, they would, when the need arose, buy cheap imported calories, mainly carbohydrates in the form of cereals, sugar, and syrup, and their original more or less precariously balanced diet thereby deteriorated. As far as health is concerned, the increase in dental caries is often one of the first indications of this unfortunate development. Also, observations have been made where the incidence of tuberculosis, venereal disease, and rickets increased. The introduction of the cheapest types of canned (tinned) food, biscuits, and so forth, contributed toward this. Tobacco and alcohol certainly did not improve the nutritional picture or health conditions generally.

But the influence of a completely alien and much stronger culture which is being more or less forced upon a defenseless indigenous population goes, of course, far beyond this.

This is not the place to go into all the mistakes and crimes which have been committed in violation of humanitarian and other principles during the past. As far as health is concerned, a considerable number of diseases seem to have been introduced to these indigenous populations by such arrivals from the South, without at the same time taking even elementary precautions.

In introducing health services to such indigenous populations in the North, one will, in principle, meet with the same obstacles which are now so well known from other underdeveloped parts of the world—poverty, illiteracy, ignorance, superstition, family traditions, unhealthy life habits, including close con-

tact with dogs and other animals, and so on. Added to this is also the lack of available literature for educational and other purposes in a language understood by those few who may be able to read such books. Audiovisual methods (the spoken word through radio broadcast and television) have already been applied with success in certain places. The situation differs from that found in technically underdeveloped areas elsewhere in the world by the fact that the indigenous populations in the North are not constituted of masses, of millions, even hundreds of millions who dominate by their very numbers. In the arctic and subarctic regions we have to do mostly with groups of several thousands or tens of thousands. New settlers will therefore also quantitatively play a much greater role. One may hope that this, together with the lesser magnitude of the problems, economically, will shorten the period until more satisfactory health services have been introduced for these indigenous populations. Also, one must hope that the extensive experience gained in establishing health services in other underdeveloped parts of the world should help in protecting against some of the mistakes made there.

4. The fourth main type of population in the areas under consideration, the transient "expeditionary force" type, presents attitudes and health problems different again from those mentioned above. They will vary greatly according to the size, purpose, and duration of stay of the station personnel, to the latitude, as to whether the unit is supposed to be mobile or not, whether it can be easily reached and supplied by air or by ship, and so forth. Obviously, the health and related problems of Nansen when he traversed the icecap of Greenland on skis in 1888, or those of one single hibernating Canadian trapper, are different from those of a well-established American or Russian meteorological station housed in a properly planned building in the Arctic or Antarctic.

As far as the somewhat larger expeditionary groups are concerned which for scientific, strategic, or commercial reasons have to spend shorter or longer periods in such areas, the situation is greatly simplified by the fact that the economic obstacles to the application of adequate health services do not in the main exist. The problem is reduced to one of technical know-how, proper planning, and execution. In principle, such arctic or antarctic station personnel will ask for protection of life and health on the level found at home, or often on a higher level. The task, therefore, presents itself in the form of adapting preventive and curative health services, environmental hygiene, nutrition, cultural activities, and mode of life generally as much as possible to the special conditions at the station.

A host of technical details have to be known and taken into consideration. During the last decades, and especially after the Second World War, a rapidly increasing amount of knowledge based on sound observations has been piling up. Painful and costly experience has also demonstrated the necessity of preassignment medical examinations, somatic and mental, for the exclusion of individuals who might not stand up to the special types of stress.

Generally speaking, experience until now seems to demonstrate that, while it is not too difficult to establish a healthy physical environment, it is impossible to create a mental milieu fully satisfactory for the average individual coming from more "civilized" parts of the world. This does not mean that life in general in arctic regions is incompatible with mental health. Several surveys have been made demonstrating this among various types of populations in northern regions. In his social psychiatric investigation of a small community

in northern Norway, for example, Bremer* demonstrated that the prevalence of various types of mental diseases and disorders in a stable population close to 71° N.L. do not seem to show great differences from figures found in populations further south. Also, in indigenous, technically underdeveloped populations of the Arctic, mental health problems, to the extent they are known, do not seem to present insurmountable difficulties. The mental health problems so often encountered in station personnel have more to do with the completely artificial situation in which that personnel finds itself. Similar problems are well known from expeditionary groups elsewhere in the world, among isolated missileers, in crews on merchant ships during long sea voyages, and the like.

A final point on the psychological reactions to arctic and antarctic conditions: For people who know only a form or temperate climate and are accustomed to crowded city life, it may be natural to underline the cold, the "frozen" nature, the depressive effect of the long sunless winter night, the blinding blizzards, the lack of variations, the loneliness. However, there is also an antithesis: The spring in the North, the tremendous stimulus of the change and variation, the incredibly invigorating effect on life of the light, the unparalleled beauty of the northern lights, the deep satisfaction by feeling body and mind gradually gaining strength to fight and conquer an unfriendly nature, the wide horizons, and limitless possibilities. All this offers a compensation which many people, once taken in by the Arctic or Antarctic, will never forget and always miss.

After all, historically speaking, man originally lived in isolation surrounded by the forces of nature and by vast uninhabited areas. The most specific delight and relaxation which a not inconsiderable number of people experience in the gigantic vastness of the North may, therefore, phylogenetically speaking, have a very solid basis.

* J. A. Bremer carried out a psychiatric census by the computation on a certain date of all the persons suffering from any type of mental disorder or disease in the total population of approximately 1,300 individuals of the district (1122 km^2) in which he had been working as a local public health officer (and only practicing doctor) during five years. The area is close to 71° N.L. with three months' arctic night and a correspondingly long period of midnight sun. There was found a relatively high prevalence of psychiatric disease and disorders. Lack of fully parallel intensive census surveys elsewhere makes direct comparison impossible.

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